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ABSTRACT

This handbook offers a teach-yourself guide for teachers, administrators, and researchers on the management of educational media and materials. Management of instructional media is often complicated by overlapping functions and responsibilities of various government levels and administrative positions. The guide contains one learning module, which presents information on the use of educational resources and materials, and a flexible learning unit for individualized study. The module is comprised of three sections: (1) approaches to categorizing and managing educational media and materials; (2) needs and costs; and (3) implications of the use of educational media and materials. After completing the module, the reader should understand concepts of educational technology and be able to conduct a cost-effectiveness study of a country's educational technology needs. The handbook begins with a detailed analysis of two UNESCO references: (1) "The Educational Administrator and Instructional Materials" (Jean Valerien, 1984), and (2) "The Economics of New Educational Media," Volume 2, "Cost and Effectiveness" (1980). Four tables and two figures are included. (LMI)

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Instructional media in educational planning and administration and school building

Teach-yourself guide to the management of educational media and materials

Educational Policies
and Management Unit

UNESCO

Do you feel that the following are your concern:

improving the quality of education,

modernizing the education and training system,

improving management and seeking to reduce costs,

reducing the amount of foreign exchange spent on educational imports.

If you do, then this manual is for you

Printed media, manuals and materials are today an integral part of education, so much so that it is now impossible to imagine a school without books.

As years have gone by, increasingly numerous and sophisticated teaching instruments have been introduced into the learning process, often as opportunity arose and sometimes because of changes in fashion. Audio-visual facilities, scientific and technical equipment for the teaching of science and for technical and vocational training, special facilities for art teaching or the practice of physical and sports activities and, more recently, data processing equipment and microcomputers constitute a considerable range of 'educational media and materials'.

Altogether this impressive list, worldwide, represents a major item of expenditure, put by economists at *some 5 per cent of total educational spending.*

Awareness of the need for this vast expenditure to be properly managed is growing and the optimum use of human and financial resources connected with educational media and resources has *now become a priority.*

This guide will be of direct interest to you if you are:

a teacher responsible for designing apparatus, a textbook or material;

head of a school or similar establishment with responsibility for the proper use of the equipment and programmes available in your centre;

an education inspector responsible for testing and assessing teachers and what they teach;

an instructor or head of a training establishment in a position to introduce or deal with the subject in a basic teacher-training programme or during in-service training for teaching staff;

a researcher, specializing in the problems of teaching methods, quality assessment or educational economics;

an administrator at any of the various levels of the education system (local, provincial, national) *and in addition having special responsibility for introducing educational media and materials* (at the educational, technical or economic levels, for example);

a person responsible for research and production in a unit producing educational media and materials, or in a specialized structure responsible for managing such media and materials;

a manager, responsible for the optimum use of material, financial and human educational resources;

member of a working party involved in research on *curriculum development.*

...

You could likewise be:

a 'decision-maker';

an 'actor' who is an occupant of a post belonging to one or other of the above categories;

a 'resource person' or a 'specialist' who does not belong to the management system of educational media and materials or even, in some cases, to the education system itself but who may be asked for expert help or a contribution to a working party or training session (technician, economist, ergonomist, industrialist, etc.);

a 'potential actor' who does not yet belong to any of the above user categories but is *preparing himself* for such role.

The management of educational media and materials embraces *a range of many and varied activities* that may be grouped into a number of major functions.

One of the difficulties lies in the fact that these activities and functions overlap each other in time and are not necessarily made the responsibility of identified institutional actors.

Does that sound complicated? Take an example. Establishing a quantitative requirement - e.g. the number of appliances of a given type required for secondary education - may be done by several different authorities (science inspectors, the secondary education directorate, the ministry's planning department, the studies directorate, the national centre for the provision of scientific materials, etc.). In our example, who - once the requirement has been determined - is going to decide whether materials should be purchased or manufactured? Who will be responsible for their distribution? Who will tell teachers how to use them? Who will check whether they are being used correctly? Who will evaluate results in terms of improvement in the quality of education? Who, finally, will be responsible for liaison, co-ordination and synthesis between these various 'who's"?

This is why the information put before you in this guide is divided up into '*modules*'.

Each module deals with a given conceptual field and represents a *flexible learning unit* for students on their own or in small groups without the constant presence of an instructor.

Each module is itself divided up into sections covering a part of the conceptual field concerned. The *section* we could call the *base unit* or lesson, equivalent to a given volume of study.

Because the subject is complex, some aspects are dealt with in more than one module, e.g. the question of textbooks is dealt with twice:

a study in module 2, section 1 covers priority instructional materials, i.e. those that provide the biggest improvement to the quality of education for a given cost; and

a more economic-oriented approach in module 3, section 1 relates to the possibility of setting up a national education industry.

Each section in each module is a study unit

The purpose of the modules and sections is to allow students:

to work at their own pace;

to select learning objectives tailored to their own situation, paying special attention to the information and areas they want to develop and skipping those that do not appear to be relevant;

to spend the time they need to attain their own objectives, not being required to go at the same pace as the group (if given in an intensive seminar, the same training as that given in this guide would require a *two weeks' course or 6 hours* per section; with the teach-yourself guide the premise at the start was that for a student working on his/her own, one section could be spread over a period of one week so the guide as a whole would require in-depth study *stretching over a three-month term*);

to monitor their own progress since they are very much involved in the development of their training; and

to work where and when they so choose.

... But remember - the guide is not the only source of learning

You also have to:

study the books referred to in the modules or the bibliography in the appendix;

take your own experience and data specific to your own country into account; and

identify, for *each section* and each module that you have decided to study, *the resource persons that you may want to meet and consult with at the local level.* Your study of textbooks, for example, may prompt you to contact, if possible:

a manuscript designer,

a printer,

a school head,

a user, etc.

Some other problems are tougher and less easy to solve, e.g. the identification of resource persons in the case of financial resources or public procurement procedures may be especially difficult. In that case, do not forget

that you can always consult your UNESCO National Commission or the centre or agency that administers educational resources and materials at the national level (national educational technology centre, national centre of educational literature, etc.).

This contact with resource persons is essential to enable you to get deep into the subject, pinpoint national specificities more clearly (the guide is deliberately international) and to confirm or otherwise what you have learnt.

The four modules cover the following subjects, in this order:

the use of educational resources and materials (what does the term define and what does it imply?);

three examples related to three priorities (textbooks, instructional scientific equipment, and new technologies);

production structures and administrative structures;

the study of costs, project financing and public procurement procedures.

The end-goal of the guide is to prompt you to get more deeply involved. Depending on your skills, your level of responsibility and the interest you have in a particular field you should, at the end of studying the guide, be able to become involved in a project that may be small but will be one in which you yourself will have an active role.

For that too - which we are merely proposing, of course, and which is therefore wholly optional - do not hesitate to call on the resource persons you have identified and first and foremost, if necessary, on your UNESCO National Commission.

At various places throughout the guide you will come across giant exclamation and question marks, the exclamation marks relating to something you are asked to think about or do and the question marks to questions to which you are asked to find the answer.

In the field of the management of educational media and materials, things are not as linear and strict as they are in mathematics and physics. In other words there are not really any universal and exact answers so that in this case *what is asked of you is to think deeply rather than anything else*.

The author of the guide wishes you success in your study.

Instructional materials in educational planning and administration and school building

Teach-yourself guide to the management of educational media and materials

Module I: Educational media and materials

Introductory notes: Notes on recommended reading

Section I: What are educational media and materials?

Section II: Costs, needs and functions to be considered

Section III: Implications of using educational media and materials

Division of Educational Policy and Planning

Division of Educational Sciences

UNESCO

Teach-yourself guide to the management of educational media and materials

This series is made up of the following:

Foreword

Introduction and how to set to work

Module I: **The use of educational media and materials**

1. What are educational media and materials?
2. Needs, costs and functions to be taken into account
3. Practical implications of the use of educational media

Module II: **Three examples - three priorities**

1. Textbooks
2. Scientific instructional materials
3. New information technologies or NIT

Module III: **Production and documentation structures**

1. Production of textbooks
2. The education industry
3. Documentation, curriculum, training

Module IV: **Cost studies, financing of projects, contracts**

1. Working out unit costs
2. Formulation of a project and sources of finance
3. Contract procedure, public procurement
4. End of the module and the guide

Appendix: **Bibliography**

Module I: Educational media and materials

General considerations, objectives, definitions

Introductory notes on recommended reading

Section I: What are educational media and materials

I Alphabetical list of educational media and materials
II Functional approach
III Administrative approach
IV Teaching approach
V Economic approach
VI Political approach

Analytical matrix

Section II: Costs, needs and functions to be considered

I Need for use of educational technology
II Global approach to the cost of educational media and materials
III Needs and cost-effectiveness
IV Application at national level
V Functions to be considered

V.1 Planning
V.2 Provision
V.3 Distribution
V.4 Monitoring the use of educational materials

Recapitulation tables: analysis by level and medium

Section III: Practical implications of the use of educational media

I Implications in terms of staff
II Implications as regards documentation and distribution
III Implications in terms of production
IV Implications in terms of assessment
V Implications in terms of administration
VI Financial implications
VII Technical implications

Conclusion

Module I: Educational media and materials

General considerations

The purpose of this module is to map out a complete problem area and identify all the factors that need to be considered in the management of educational media and materials

whether in support of the learning process in face-to-face teaching, or

forming a full-scale integrated education system in the framework of non-formal education (or distance education).

Module I is in three sections:

Section I: What are educational media and materials?
Section II: Needs and costs
Section III: The implications of their use.

Objectives

At the end of this module you should be able to:

(1) *Fully grasp the concepts of educational technology* (educational media and materials, cost-effectiveness ratios, identification of functions to be provided and the forecasting of implications and applications bound up with the use of educational media and materials).

(2) *Make an initial study and analysis for your own country* (calculation of costs and needs, criteria to be considered in setting priorities).

The bibliography given in the appendix includes two books that will help you in your thinking and study on this first module:

The educational administrator and instructional materials.

The economics of new educational media (Vol. 2: cost and effectiveness).

This explains why module I has an introductory note on the reading of these two UNESCO publications.

Introductory note on the reading of:

The educational administrator and instructional materials (Paris, UNESCO, 1984, 180 pp.), Jean Valerien

This book is 'directed towards all those needing to have *an understanding of the management of educational materials*, at all levels of the educational system'. It 'stresses *problems encountered by national services*' (Preface). It therefore reserves those of 'the actual organization of media in educational institutions' for another UNESCO publication.[2]

The *Introduction* sets out a number of axioms that define the general problem. It is first stated that 'the role of educational materials and equipment is growing more and more important in education' and then that 'educational research has stressed the importance of manual dexterity and the linking of education to life situations' (p. 9). As a result it has become essential to train *specialized administrators* 'to solve the problems posed by the procurement, maintenance and efficient use of educational materials and equipment', a requirement that is even more crucial for the developing countries which face the 'hardest problems. In these countries, the adoption of national policies ... can be one way *of solving the problem of rational management of educational materials and equipment*'. This explains why 'examples from countries with centralized educational systems are highlighted in this work', whilst ensuring that 'the economic point of view is closely linked to that of education' (p. 10) since 'preoccupations of a strictly educational nature often fall by the wayside when decisions about equipment procurement are made' (p. 23).

Part one, headed 'Defining the problem', takes the typological approach to educational media (hardware - apparatus and equipment - and software - programmes and materials).

From an operational viewpoint, three main categories of educational materials and equipment are distinguished: furniture, instructional materials (textbooks and other books, materials for science teaching, equipment for physical education and sport, equipment and material for teaching technology and vocational training, audio-visual media and computer technology) and stationery and supplies.

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1 The two introductory notes on recommended reading are by Mr Maurice FAUQUET.

2. Technical and economic criteria for media selection and planning in educational institutions, educational studies and documents, 48, Paris, UNESCO 1984. A note on the reading of this book is given elsewhere.

From the administrative standpoint account needs to be taken of criteria relating to:

(a) the nature of the equipment and materials;
(b) the cost (investment and expendable items);
(c) their life (capital assets);
(d) mode of financing;
(e) mode of production;
(f) the industrial sector concerned;
(g) the economic development plan in force, and not forgetting;
(h) the type of educational use (individual, small group, community) (see recapitulative table on page 21).

Though primarily financial, the stakes are also and just as much educational. Nevertheless, 'in most cases, there is an evident lack of foresight as to what an education system, having mastered technological development, could become' (p. 23), for there are many obstacles (pp. 24-25) to the educational development of new technologies which ought to be primarily regarded as 'means for innovation' (p. 23). Conversely, care is necessary to avoid the risk of 'dependence induced by the widespread introduction of educational materials which have not been fully mastered' (p. 25).

This being so, Part two of the book headed 'Main functions to be taken into account in the management of educational materials and equipment' has that much more importance.

Its *first chapter* concerns 'planning', the first requirements for which are to identify the objectives (pp. 31-32) and then to identify the needs (pp. 33-34). Close attention should be paid to the four types of '*Classification of costs*' (pp. 36-37), i.e. technical, economic, accountancy or budgetary and, lastly, financial by contributor as proposed by education economists.[3] There is also the distinction between unit cost per student and unit cost per student/hour (p. 38) and the notion of 'critical mass' with which a '*threshold of economic efficiency*' can be determined, i.e. 'the point at which a system using educational media becomes more economical than a traditional one' (p. 39). We shall look at two of the examples given, one as a centralized system (Czechoslovakia) and the other as a decentralized system (United States), where the 'Federal Government provides each State with sufficient funds for each micro or macro system to organize its own education system', given the fact that 'relations between the school, the city, the district, the county and the State education authority may differ from one State to another' (p .41).

3. See also: The economics of new educational media. Vol. 2: cost and effectiveness (Paris, UNESCO, 1980, pp. 23-25, with the table drawn up by F. ORIVEL), and Technical and economic criteria for media selection and planning in educational institutions (Paris, UNESCO, Educational studies and documents 48, Part two of which sets out an application (pp. 59-75) of this cost classification by F. ORIVEL to the assessment and analysis of educational media).

Chapter 2 in Part two concerns '*Provision*'. The first subject dealt with is 'developing technical specifications' (pp. 44-47). This 'establishment of norms and research on standardization is a matter for international co-operation in which UNESCO fully co-operates'. A detailed and significant illustration is given at the end of Appendix I (pp. 163-173) under the heading 'Technical specifications for audio-visual equipment'. With regard to the 'selection' of equipment, 'it has to be recognized that there is as yet no known scientific method of systematically assessing materials' and that in this area methods give way to a 'certain natural empiricism' (p. 49). However this may be, the fact remains that the selection of instructional materials should, in principle, be 'carried out according to precise criteria' which can be classified under 'general, educational and socio-cultural' headings (p. 49).

Provision often requires a 'vital decision' to be made, namely 'whether to *purchase* an item on the market or to *undertake its production* (p. 50), bearing in mind the fact that the 'education market' represents only about 2-3 per cent of the domestic market (p. 50). With regard to '*purchasing procedures*', three possibilities are discussed together with their pros and cons (pp. 51-52): preference specification, prescription specification and performance specification. The problems of 'production' are presented by taking two examples - Czechoslovakia and France (pp. 53-55). It is recommended, for the developing countries in particular, that a clear distinction be kept between the role of the '*educational sector*', which is 'to plan its needs, prepare specifications, control the quality of products, organize their distribution and monitor their use' and the role of the '*industrial sector*' which, 'on the other hand, is to ensure that the materials and equipment are manufactured under optimum conditions' since 'anticipation and planning of these global needs should make it possible to produce and distribute items on an *industrial scale* either in a particular developing country or in a group of countries within a subregion' (p. 56).

Next comes '*distribution*' (Chapter III, pp. 58-63) described in terms of two examples - one a centralized system (Czechoslovakia) and the other tending towards decentralization (in the United Kingdom).

That leaves the '*use of educational materials*' (Chapter IV, pp. 64-69) which requires 'maintenance services for hardware' and, above all, the monitoring of its use. This implies the '*need for continuous assessment*', a goal that can only be attained through the '*training*' and further training of teachers and users (p. 65). Hence the value of the publication of 'evaluation guide books for teachers' (p. 65). A relevant example of this requirement to 'develop a standardized reporting process' is to be found in a statutory text of the State of Florida quoted in Appendix I (p. 130).

Points concerning 'information and training of users' are repeated and elaborated upon in this guide in the part devoted specifically to 'training problems' which deals with both initial and in-service training.

Part two of the book closes with a *recapitulative table* (p. 70) to which all administrators and managers of educational media should constantly refer.

Part three (pp. 71-98) presents a number of *'case histories'* or 'examples of organization' enabling useful comparisons to be made and offering suggestions of which users of this guide are left to make their own use depending on their own specific situation. It concludes with a 'theoretical model' (pp. 95-96) which represents a 'synthesis' of the guide, illustrated by three operational charts. The 'spirit of geometry' (or 'systemic spirit' to use a now popular expression which governs the way the guide is put together and with which it is essential to conform in the best possible manner, does not however rule out the 'spirit of subtlety' that Pascal was so insistent on for its balancing effect on the spirit of geometry. In its conclusion, the book specifically invites us to do this: 'there is no universal solution which can be transferred from one country to another. *National solutions which take into consideration the* educational, cultural, economic and technological *particularities* of each nation *have to be formulated* not only for the definition of goals for the development of instructional materials but also for the choice of strategies for their implementation' (p. 102).

The Appendices constitute half the book and they should not be treated as unimportant. Instead they should be read attentively as significant examples of 'statutory texts' designed for various kinds of concrete situation. Purely as an indication, a number of them are referred to below, their advantage being that they give precise definitions of general significance.

For example, definitions are found of the terms 'media' and 'media centre' (p. 126), instructional 'materials' and 'media specialists' (p. 125).

We are clearly told *what a 'school textbook' should not be* (all too often it does not correspond to the real use to which it is put) (p. 146).

There are variants for *what it should be* (FRG: pp. 119-120, France: p. 146). The French Circular calls for textbooks to be 'lighter in content', since nowadays, 'as a complement to the textbook, pupils will also be able to use (other teaching instruments) collectively or individually'. In this connection, with regard to audio-visual media, care should be taken to see that 'the overall equipment of a school or group of schools is progressively constituted on the basis of the articulation of the following prospects of utilization for teaching purposes' as set out in a French Ministry of Education Circular in 1977 (pp. 156-161).

The book ends with an 'alphabetical list of educational materials and equipment' and a selective bibliography.

Introductory note on the reading of:

'The economics of new educational media' Volume 2: Cost and effectiveness (Paris, UNESCO, 1980, 316 pp.)

Although the necessary brevity of an introductory note forces us to leave them aside, the reader is strongly urged to give very close attention to the case-studies, abstracts and reports of meetings that make up two thirds of the book. They are a mine of useful information on major experiments. They provide material for fruitful comparisons and offer many suggestions for those who are conducting or may have to conduct similar development operations.

So here we confine ourselves to the first 86 pages for the following methodological reason: an analysis of this first part of the book yields the theoretical structure that should underlie any action to develop any educational system in which the optimum use of new educational media is rationally integrated. It should clearly appear that this analysis links up with and extends our work on the 'semantic field of the evaluation concept'.

The title of this first part is significant. It starts with 'results' and works back to questions about outstanding problems. The results are present-day answers to a contemporary problem. At a time when 'the education budget is hardly increasing at all in real terms' (p. 10), 'the enormous growth in the demand for education over the past 30 years has forced us to *take a fresh look at this problem*' (p. 9). The question relates therefore to the 'possibility of satisfying these immense needs by solutions other than traditional schooling' (p. 10). There already seemed to be the beginnings of an answer in the accelerated technological development following the Second World War: 'The fact that technological progress has increased the capacity for transmission of all kinds of information over a distance has naturally directed research *towards those systems that make use of the various media* (p. 10). This move from the artisanal to the industrial stage in education, coupled with an increasing scientific requirement characterized by the concern for quantification, explains the *very recent introduction of econometrics in the study of education systems:* it has, thus, very quickly become apparent that economic analysis could and should help throw light on the problems that educational planning faces today, by systematically comparing the cost and effectiveness of the various solutions' (p. 10).

As regards the classification of costs, it is useful to compare the tables produced by J.C. EICHER (p. 11) and F. ORIVEL (p. 25). Based on the 'agreement' of a group of experts that met in 1976-1977 and whose conclusions are summarized by J.C. EICHER (p. 11) and elaborated upon by F. ORIVEL (pp. 23-25) the nomenclatures arrived at are nevertheless a little different, the reasons for the differences being clearly explained by F. ORIVEL (pp. 25-26). So the latter's table has to be preferred because it provides 'a useful, exhaustive and "realistic" picture of costs' (p. 25) and above all it is the table that is used in

'technical and economic criteria for media selection and planning in educational institutions', part two of which (pp. 59-75) describes an application of this classification to the assessment and analysis of the costs of educational media.

This importance attached to costs is due to the fact that 'it is the net summary of the costs and benefits that should influence the decision' (p. 16). So use is made of 'cost-benefit analysis', the theory of 'human capital' and the notions of 'educational investment' and 'rate of return' (p. 16). '*Cost-effectiveness*' analysis is generally based on 'a broader definition of benefits - and not only monetary ones' (p. 16). In this connection, J.C. EICHER admits that 'the notion of effectiveness has many facets and needs to be defined' (p. 16) and that it generally boils down to 'instructional effectiveness measured in its strictest sense, that is to say by results of achievement tests' (p. 16).

Problems already arise at this level and we must beware of the 'ambiguities' and 'shortcomings of effectiveness indices' (pp. 17-20). We have to be fully aware that 'cost-effectiveness analysis therefore only provides information that must be evaluated by the decision-maker; it does not provide objective and definite criteria of choice' (p. 21). Whilst the 'tangible progress achieved over the past few years' is to be welcomed it is important to bear in mind the 'limitations, difficulties and dangers of analyses which are too directly derived from neo-classical economic analysis and which therefore share its technical limitations as well as its ideological presuppositions' (p. 21). Moreover, 'one is not entitled to use for other various situations and types of communities a procedure that is fully justified only in a competitive capitalist economy' (p. 13).

The chapter by S.J. KLEES and S.J. WELLS goes more deeply - by setting them in their original context, that of so-called liberal economic theory - into the techniques of cost-benefit and cost-effectiveness analysis in their relation to the theory of human *capital* and concepts such as *rate of return*, the *production function*, *labour planning* and the *study of social demand* (pp. 35-47). This chapter stresses and explains the 'critical problems' that J.C. EICHER only mentions and concludes that 'in all cases, our ability to rigorously quantify the conceptual variables we do consider theoretically important is inadequate' (p. 43).

One finds oneself wondering - irony of ironies - whether 'quantitative empirical investigations of relationships add something to our individual or collective common-sense judgements' (p. 43 and footnote 1).

The concluding remarks should be pondered on:

(1) Is not the systematic tendency to use only the most easily quantifiable *criteria* an obvious drawback? (p. 44)

(2) As regards effectiveness, 'there appears to be undue emphasis on cognitive outcome assessment' (p. 44), whereas it may be argued (and there is evidence in support) that 'there are *affective and/or certification effects* of the schooling process that may be more relevant to employment and productivity than cognitive skills' (p. 44).

(3) Another point to be considered is the fact that 'much of the research undertaken to evaluate instructional technology alternatives is sponsored by agencies that have a vested interest in the technology projects themselves' and therefore suffers from an 'implicit *bias in favour of the technology*' (p. 45) which distorts the results.

(4) Lastly, 'is competitive market theory a reasonable framework on which to base educational analysis, or is it simply a *reflection of ideological prejudices*?' (p. 45).

To conclude, 'economic analysis is most useful to the extent that it makes decision-makers more aware and more explicit about alternatives and their various consequences. Once again, however, such analysis should not be taken as definitive but as *informative*, to be interpreted with caution and common sense, based on the knowledge of both its strengths and weaknesses' (p. 47).

The next chapter, by E.G. McAnany, deliberately rejects the reductive temptation of economic analysis and provides 'an overview of the evaluation results of a non-economic kind for the application of educational technology in Third World countries' (p. 48). Instead, he stresses *another type of factor which he calls contextual or structural*, arguing that 'all social interventions' are based on *non-economic 'values'*, and has no hesitation in asserting that 'the successful application and significant deployment of communication technology in formal and non-formal education depends more on the contextual or structural factors of the particular setting than on the planning and design factors', which 'professional planners do not seem to realise' (p. 49). The efficiency question raises that of objectives which, as the author has already said, are a 'slippery reality' (p. 50). In the present case, a 'careful distinction' has to be drawn between *internal efficiency* (related to short-term objectives) and *external efficiency* (related to long-term objectives). Expected results are no longer the only ones to be taken into account. There are also the side effects and there should be no surprise at the reference here to SCRIVEN's concept of 'goal-free evaluation' and SCHUMAN's term of '*process evaluation*'. Consideration of those who benefit (rather than simply the benefits themselves) extends evaluation to the larger field of *equity*.

In that light, contextual factors therefore need to be kept carefully separate from planning factors.

First among the later is the *'political commitment of a government to change and development'* (p. 54) which provides a 'kind of *charismatic* support

that leadership can lend to the work of project personnel' (p. 54). However, this political commitment can only have full effect if the '*motivation of the target-audience*' is expressed in the 'enthusiasm of the population which sees the usefulness of the project and the interest it holds for them' (p. 55).

Clear understanding of planning factors (pp. 55-56) is of course needed to add strength to the momentum generated by contextual factors. In this broader perspective, the author then goes on to review seven educational technology projects and judge their 'success'.

Note, in passing, the difficulty referred to of expanding experiments to 'operational systems' (p. 57).

The 'conclusions' urge that the following be taken into account:

(1) implicit/explicit *values*,

(2) *external efficiency* (long term) to be given as much attention as *internal efficiency* (short term) if not more,

(3) *contextual factors* to be given as much attention as *planning factors* if not more, and

(4) *equity* to be given as much attention as *efficiency* if not more,

in every case with a sense of proportion, in the Hellenic sense of the term which is not limited to purely mathematical measurement:

'Finally, returning to my basic thesis of the preponderance of contextual factors over planning factors, I do not wish to give the impression of a necessary contradiction between the two. Rather, *I see the most successful application of communicational or educational technology when both contextual and planning factors are favourable*' (p. 59).

This practically rounds off the question. The following articles to some extent duplicate the earlier ones and therefore here we simply pick out any items of information not already given.

One example is the list of factors that Kiran KARMIK would like to be included in the function defining benefit viewed in its widest coverage (p. 64) which needs to be thought about (given the quotation from Cohn-Bendit and the reference to Marcuse) because a school is not to be confused with a factory.

But the last article gives a useful summary of the *notion of efficiency*: 'Where project choice is made solely on the basis of effectiveness, the project designer implicitly decides to forgo efficiency as a criterion' (p. 68).

Three complementary ways of measuring results are put forward:

(1) 'A first measure is based on the concepts of *target and actual audience*' (p. 72).

It is accepted that 'presence is not synonymous with absorption and should not be treated as if it were' (p. 73). The point is that this type of measure 'yields an inefficient choice because it ignores the value of what is being taught' (p. 74). At very most 'it can be useful to programme administrators to see where they can increase the intensity of participation in their programme' (p. 74).

(2) The second relates to 'achievement measures' (p. 74) which are vulnerable to the criticism levelled at knowledge testing which possibly puts too much weight on the level of knowledge memorized (p. 75).

(3) '*The behavioural measure*', on the other hand, involves a more complex set of behavioural responses than the achievement measure and as a result it lays down 'a more stringent measure of effectiveness' (p. 77).

This type of measure is more suitable for 'effectiveness-cost analysis' (p. 78).

Another section, aggregate economic measures, deals with the effects of education systems on 'productivity' (p. 79), 'the distribution of the population between rural and urban areas' (p. 80), the 'accumulation and production of capital' (p. 80) and 'income distribution' (p. 81) involving 'equity considerations' (p. 81) which are broader than those of effectiveness (p. 81, footnote 3).

The article ends with a review of the various ways of collecting data (by survey, from programme administrators, from national and international agencies and by making use of other countries' experience).

The author concludes by repeating his initial reservation, i.e. 'that the vast majority of effectiveness studies pay homage to the concept of cost-effectiveness but fail to practise it in reality' (p. 86). The circle is thus completed.

In the end it is up to those responsible for launching and running projects to keep all the threads of the skein well in hand.

Definitions

On the page before we used the terms 'face-to-face teaching' and 'non-formal education'. Do you know what they mean?

> Face-to-face learning is that given by a teacher, in a classroom, face-to-face with his pupils.
>
> Non-formal education does not involve this face-to-face relationship; the teacher or instructor is not always present and self-teaching is systematically encouraged.

Throughout our guide we will be using the vocabulary of what is called 'educational technology'. Another unfamiliar term?

> Educational technology is a systematic way of designing, applying and assessing the whole of the education or learning process taking into account both technical media and human resources and the interactions between the two, so as to increase the effectiveness of education. As its theoretical instrument, educational technology uses *systems analysis* which is a process wherein a system's components and interrelationships are identified and the problems bound up with the design and functioning of systems are identified and studied.

Our reference will be the glossary of educational terms published by UNESCO in 1987.

But let us get to the point. We have to define the subject of our studies: educational (or instructional or training) media and materials. This will be the purpose of section I of this first module.

'Educational (or instructional or training) media and materials' is a generic term embracing all aids to the learning process, including both:

> hardware (equipment and appliances) and
>
> software (books, films, television and radio programmes, and courseware).

A first difficulty lies in the exact coverage of the words, 'media' and 'materials' which, in ordinary language, have a very wide range of meanings, media generally being used for 'communication media' and materials for physical resources of every kind, including print and non-print materials used for teaching purposes.

For the purposes of this guide, the following definitions will be observed, taken from the glossary we have just referred to:

Educational media:

> the devices and materials used in the teaching-learning process. The term is often used as opposed to instructional aids to denote those means which present a complete body of information and are largely self-supporting rather than supplementary in the teaching-learning process.

Materials:

> the learning resources used either in the process of instruction or in its production, reproduction, transmission or display. Materials are usually consumable or non-mechanical items.

Instructional materials:

> a generic term denoting all print and non-print materials used for teaching purposes.

Complicated, is it? Leave it for the moment, things will get clearer when you go through the list of media and materials that follows.

Section I: What are educational media and materials?

I. Alphabetical list of educational media and materials

Educational media and materials embrace a very wide spectrum of highly varied products as can be seen from the following alphabetical list taken from a recent exhibition of instructional aids.[4]

A

Aids for the disabled
Art books
Atlases
Audiotape recorders/players
Audio-visual accessories (e.g. microphones, lenses)
Audio-visual editing
Audio-visual instructional media: software
Audio-visual programmes
Audio-visual stock (e.g. blank film, audio and videotape, etc.)

B

Big-screen television projectors
Blackboards and accessories
Books
Books for young people

C

Cameras
Cassette recorders and players
Children's books
Computer and electronic installations for instructional purposes
Computer hardware, electronics
Computerized and electronic educational equipment: hardware
Copying decks for magnetic tape

D

Data centres
Demonstration equipment
Demonstration equipment for teachers' use
Discs
Distribution of accommodation
Dictaphones
Domestic science schools

E

Electronic instructional media: software
Electronic film handling equipment
Electronic learning systems
Epidiascopes
Episcopes
Equipment for manual work and the plastic arts (painting, modelling, do-it-yourself)
Equipment for school kitchens and domestic science schools
Equipment for taking and reproducing pictures
Equipment for technical activities
Equipment for vocational training and further training
Exercise books
Experimental apparatus for teachers' use

4. 18th **Didacta** (European exhibition) held in Basle, March 1981 collections.

F

Film projectors
Films
Fossils
Friezes
Furniture for kindergartens

G

General school equipment (e.g. lighting, room-darkening systems, school maintenance materials, distribution machines and accessories)
Globes

H

Handicrafts
Health care
Hi-Fi installations

I

Information (administration, organization, documentation)
Installations for instructional purposes
Installations for language teaching
Installation of special premises
Instructional construction sets
Instructional games

L

Laboratories
Language laboratories
Lesson programmes
Lesson programmes using the computer
Lexicons
Listening equipment

M

Magnetic tape
Measuring instruments
Media centres
Minerals
Miscellaneous
Models
Multimedia services, packages
Music
Musical instruments

O

Office equipment
Optical equipment (e.g. magnifying glasses, microscopes, telescopes, etc.)

P

Periodicals
Photographic equipment (cameras, darkroom equipment)
Photographic slides
Picture books
Precision balances
Preparation
Printed lesson programmes
Projection equipment

R

Radio equipment
Recording studios
Record players
Reference books
Reliefs
Rocks

S

School catering
School clothes
School furniture
School health and hygiene
School kitchens
School workshops
Seating for large halls
Self-training apparatus for students
Slide projectors
Special premises
Specialized literature
Sports clothes
Sports equipment
Stationery
Stick-on notice boards
Structured instructional equipment
Studios for public or school television

T

Teach-yourself equipment (lessons for use in language laboratories)
Technical activities
Technical office equipment (administration, organization, documentation)
Technological collections
Television equipment
Television installations
Television monitors
Textbooks
Transparencies

V

Video

W

Wall maps
Wall pictures
Work projectors

Are there any educational media and materials that you do not know of?

II. Functional approach

One way of classifying educational media and materials is by their purpose, as follows:

School furniture

and, to begin with, classroom furniture (tables and benches for the children, platform and desk for the teacher, cupboards, etc.) but also the furniture in many specialized rooms: science room, library, infirmary, dining hall, offices, etc.

Much research has been focused on the *student's work place*, whereas the other furniture is often common to all community facilities and not specific to schools.

Stationery and supplies

in other words a whole range of items 'consumed' by students and teachers such as registers, exercise books, slates, chalk, pencils, rubbers, rulers, compasses, etc.

Instructional materials

i.e. all the media and aids used to *make it easier for the student to learn*:

toys and small instructional articles like cubes, puzzles for the very young;
textbooks;
maps, books, wall charts, etc.;
audio-visual aids;
new data processing technologies or NIT (computers, telecommunications, etc.);
three dimensional equipment for specific disciplines (science teaching, sports, vocational training, music, etc.)

III. Administrative approach

From the standpoint of administration, management and regulation, a very different classification is necessary which takes account of criteria such as:

cost;
service life;
how financed;
how produced;
degree of complexity and need, or otherwise, for maintenance.

In addition, planners will also take the following into account:

industrial production sector (chemical industry, engineering industry, etc.);
the economic development plan in force;
whether imported or not.

Consumables and capital investment

Depending on cost and service life, administrators make a distinction between:

consumables, consisting mainly of stationery and supplies and any items of rapid consumption needing constant replenishment (laboratory chemicals, chalk, registers, exercise books, etc.);

minor capital expenditure, met out of the annual running costs budget;

high-cost capital investment, with a longer service life. Such items often require decisions involving a choice and have to be programmed over a period of time. A separate capital investment budget is necessary. Capital goods have to be renewed from time to time and 'reserves' have to be set aside each year to provide the money at the foreseen date. The accountancy term for this is *'depreciation'* (in many cases, schools and other educational establishments are equipped with a range of educational media and materials at the start, but they are not replaced and there are no reserves for depreciation so they cannot be renewed).

Assets

The acquisition of media and materials (regardless of how acquired - purchase, endowment, etc.) results in the constitution of *'assets'*, which is why the accounts that have to be kept include, more often than not, the keeping of an *inventory* in the form of a book recording the nature of the item, when acquired, its price, etc. Each item is given a serial number. This register is often supplemented by a set of record cards with a detailed description of the item on one side and the various repairs made plus a depreciation table on the other.

When an item is at the end of its life it has to be withdrawn from the inventory in accordance with specific administrative procedures and 'scrapped'.

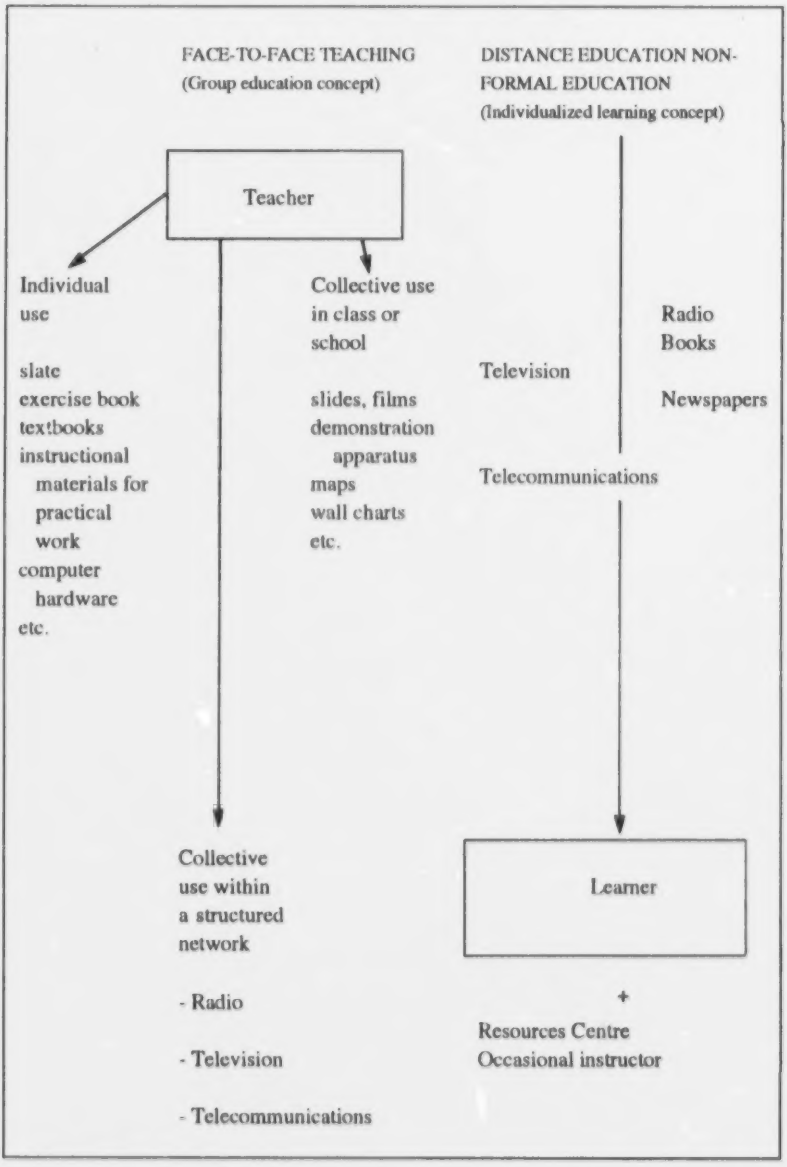
IV. Teaching approach

This approach, based on the 'utilization situation' enables the administrator to forecast quantitative requirements.

Here it is necessary to distinguish between media and materials intended for the teacher, e.g. for class demonstration, and group instructional materials, e.g. audio-visual aids.

Others will be designed for use by small groups (science teaching materials, equipment for physical education and sports, computer hardware, etc.) or even individually, e.g. textbooks and small supplies.

Some media and materials are designed to help the learner in face-to-face teaching. In this case, many teaching materials constitute *an on cost* to teaching given by a teacher whereas others, like radio, booklets, newspapers are largely integrated into a non-formal education system.


FACE-TO-FACE TEACHING
(Group education concept)
DISTANCE EDUCATION NON-FORMAL EDUCATION
(Individualized learning concept)
Teacher
Individual use
slate
exercise book
textbooks
instructional materials for practical work
computer hardware
etc.
Collective use in class or school
slides, films
demonstration apparatus
maps
wall charts
etc.
Television
Radio
Books
Newspapers
Telecommunications
Collective use within a structured network
- Radio
- Television
- Telecommunications
Learner
+
Resources Centre
Occasional instructor

V. Economic approach

An economic and financial approach is designed, in the present context of mounting social demand for education but limited resources, to help *reduce costs*.

It is therefore very important to distinguish between:

locally-produced educational media and materials, whether made by the teachers and students in schools with scant resources or directly found in the nearby environment (flora and fauna, collections of stones, visits to organizations and businesses, etc.);

education materials made on a small scale by one-man businesses in limited quantities at the local, provincial or national level (school furniture, charts, small items of equipment for science, glass-making, etc.); and ...

equipment and media manufactured on an industrial scale - it is these which require the most precision and involve technological transfer on the large scale. In most cases they are made in large quantities by:

an indigenous company; or ...

companies abroad, in which case they have to be imported, more often than not against payment in hard currency.

The table[5] below summarizes a number of options for the production and acquisition of educational materials.

5. Taken from Improving the quality of education: challenges and responses. Digest 19, UNICEF/UNESCO.

OPTIONS AVAILABLE TO THE EDUCATIONAL AUTHORITIES FOR THE PRODUCTION AND ACQUISITION OF EDUCATIONAL MATERIALS			
PRODUCTION AT NATIONAL LEVEL	PRODUCTION AT DISTRICT AND PROVINCIAL LEVELS	PRODUCTION BY TEACHERS, PARENTS AND STUDENTS	ACQUIRED FROM OTHER COUNTRIES
State production centres Big private firms	State workshops Co-operatives Small private firms One-man businesses	Teacher training. Centres at national, provincial or district level Co-operative workshops Village craftsmen Classroom, workshop in school or at home	ex catalogue Local design partly or wholly made abroad UNICEF/UNESCO assistance Multinational aid Assistance from bilateral programmes
Large quantities Small parts requiring some precision High technology Plastics	Small batches Larger items of equipment Less sophisticated processes using skills of suitable manpower	One-off items Educational value added during making Short service life Hand tools in small numbers	Small quantities Design and processes not available at local level

This economic approach will also be financial in that it will also consider the sources of finance necessary for the use of educational materials:

central government budget;

foreign aid;

local authorities;

parents of students, associations; and

the school's own resources.

The combined use of these different sources of finance often complicates regulation, which varies from country to country depending on how centralized the education system is. In one country each school will have the right to choose and pay for its instructional materials out of the budget allocated to it, whereas in another, each school will be endowed in uniform and pre-planned fashion.

VI. 'Political' approach

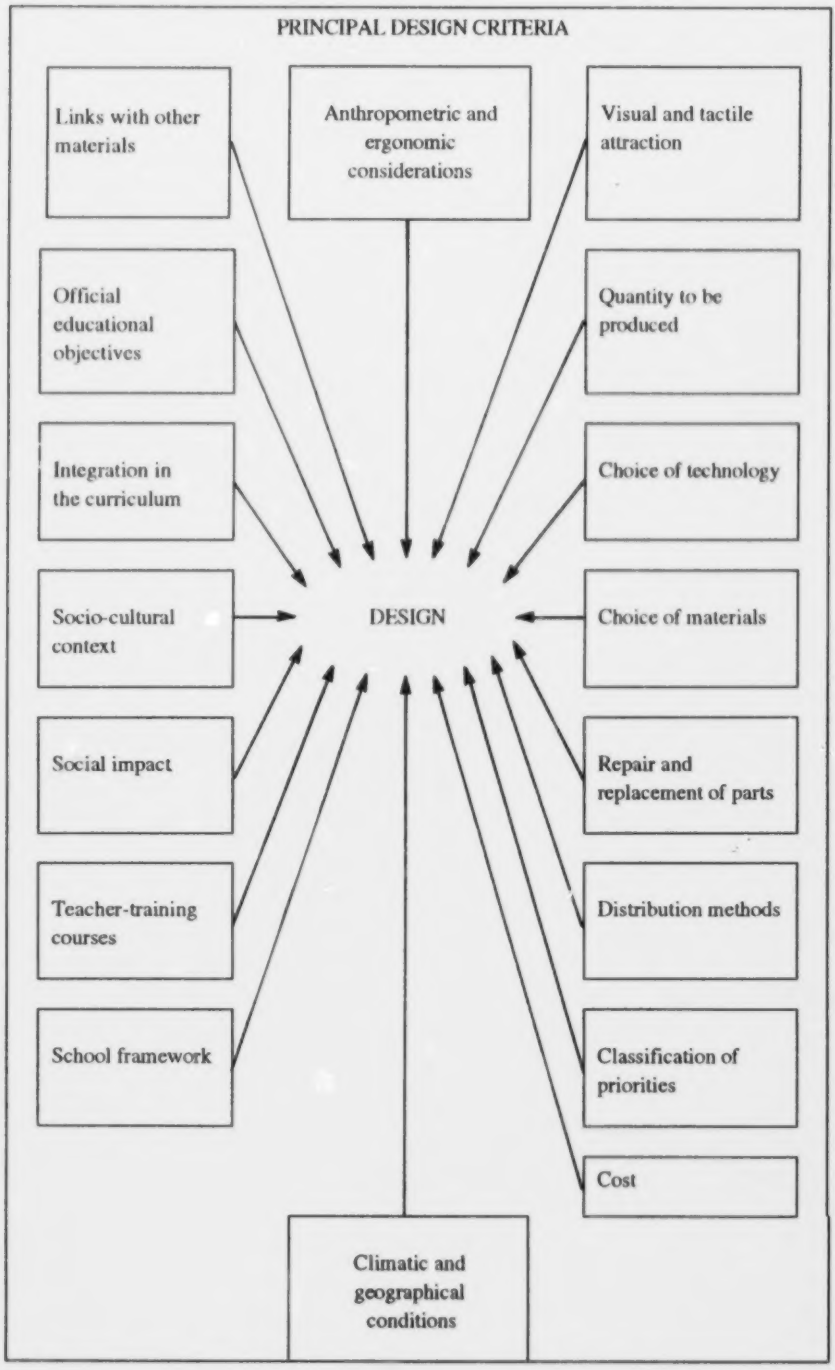
Because of the need to reduce costs and dependence on other countries, encouragement has been given to the setting up of national facilities to produce educational materials, a subject studied in more detail in Module II.

These facilities may range from the provision of a small prototype workshop in a teacher-training centre or large school in which local productions can be assessed and tested, to the creation of fully-fledged factories. In this case the choice of industry is extremely important if only in order to give preference to products of wide use not only in school but also by the community as a whole. Meeting scholastic needs may be a way of developing major national industries. School textbooks, for example, are very often basic to all national book industry policies.

Whether production be local, one-man business or national in character it is of considerable value, from the policy standpoint, to develop a *local design* for each article produced: the form and content of each of the instructional materials should be researched and established on the *basis of specific national criteria.*

The chart[6] below sets out a number of criteria (it is not exhaustive) for the solution of the problems a designer may have to face in designing educational material which is part of a range of logical and harmonious equipment, taking national specificities and the country's own curricula into account.

6. From: Improving the quality of education, challenges and responses, Digest No. 19, UNICEF/UNESCO.


PRINCIPAL DESIGN CRITERIA
Links with other materials
Anthropometric and ergonomic considerations
Visual and tactile attraction
Official educational objectives
Quantity to be produced
Integration in the curriculum
Choice of technology
Socio-cultural context
DESIGN
Choice of materials
Social impact
Repair and replacement of parts
Teacher-training courses
Distribution methods
School framework
Classification of priorities
Cost
Climatic and geographical conditions

Lastly, being an aid to help a student learn is not the only purpose of instructional materials. They are also:

Products to be used for *self-teaching* and for *increasing the skills* of teachers (the writing of a textbook is often more effective, faster and less costly than the systematic organization of a further training course).

Reference documents enabling the partners in the education system (and particularly the families that are its users) to form an idea of the content of the education given by the school (a textbook or a radio broadcast is accessible to parents who can thus form an impression of the level and subjects being taught).

Guidance instruments for the educational system and the education ministry enabling the authorities' priorities to be implemented (the publication of written material, for example, can express the priority attached to skill in written and spoken expression).

Using the typology set out above, can you draw up an analytical table and compare it with the one on the following page?

Start to make an itemized list of the media and materials in current use in your country at the different levels of education (primary and secondary). If necessary, get help from the list that follows.

Are these media and materials laid down or recommended in the statutory texts? Do any lists exist of recommended instructional materials for each level of education?

ANALYTICAL MATRIX	
Criteria to be taken into account	Fields of intervention
Types of instructional educational media and equipment	Hardware; software
Cost and life span	Immediate consumption, low cost, expensive
Assets	Inventory, renewal
Type of educational use	Individual, small group, community
Source of finance	Families, associations, schools, local authority, State
Mode of production	Standard material, specific material, local teacher or craft-produced
Industrial sectors concerned	Publishing, engineering, electronics
Economic aspects	Imports, national capacities
From 'The educational administrator and instructional materials', UNESCO, 1984	

Section II: Costs, needs and functions to be considered

Summary

What main functions have to be taken into account in order to ensure effective management of educational media and materials, and for each function, what criteria should be applied?

The following are considered in this order:

I. the inescapable nature of educational technology;

II. the global approach to the cost of education materials;

III. cost-effective ratios;

IV. application of the global approach to costs at the national level; and

V. lastly, a review of the main functions to be taken into account:

planning (with a closer look at the various costs);

provision;

distribution;

monitoring of use.

Recapitulative tables are to be found at the end of the section for considering firstly these functions and secondly the various educational media.

I. Need for use of educational technology

The use of media (audio, audio-visual, printed, etc.) is essential in non-formal education because these materials are an integral part of the learning system that has been set in place for distance education and for the literacy campaigns.

The same increasingly applies in face-to-face learning where the use of instructional materials is now an inescapable fact. Nowadays, a feature of the teaching of science is the large amount of practical work done by the students themselves. The new data processing techniques or NIT (audio-visual coupled with computer and telecommunications techniques) are now accessible to schools and it is true to say that a school without textbooks is not a real school.

Curriculum development research centres today indicate which instructional materials accompany curricula - or should accompany them - and the term 'educational technology' is slowly imposing itself.

This is how it is defined:

Educational technology is a 'systematic method of devising, applying and assessing the whole process of teaching and learning in the service of the educational objectives derived from research in the fields of human learning and communication; - *it uses a combination of human and non-human resources to achieve effective education*'.

The reason for this constant search for effectiveness is *the need to improve the quality of education at lowest possible cost.*

II. Global approach to the cost of educational media and materials

The in many cases muddled development of equipment and materials and the variety of ways in which they are financed makes any attempt at estimating with any precision the amount of money applied to them in education a particularly difficult task. One example, to be found in Finland, is sufficient evidence. In this country 18 per cent of the national budget is allocated to education, one half of this figure going to the secondary schools. In 1975, every secondary establishment received a grant of 4,443 Finnish marks per student, 290 marks (6 per cent) of which was used to buy textbooks and other books, audio-visual programmes, etc. However, since every school is wholly free to spend as it likes, any calculation at national level of the percentage spent is in no way representative of what each establishment spends individually. So it is only possible to speak of estimates.

This applies to the richest countries where expenditure on educational materials accounts for about 3-5 per cent of total educational expenditure. A survey carried out in 1976 under UNESCO sponsorship showed that in the developing countries the appropriations used in 1975 to buy educational equipment and materials amounted to about $3.2 billion. The figure for 1985 was $5.2 billion and it must inevitably be $8.55 billion in the year 2000. A substantial increase in appropriations therefore needs to be envisaged in order to be able to meet the mounting demand for equipment and materials. In addition, as Table 1 shows, the proportion of equipment and materials that is imported - currently over 70 per cent for Africa - will decline in percentage terms over the next few years, coming to about 40 per cent by the year 2000, but double its value in absolute terms.

Some research does exist however, outlined below with the help of three examples.

Class size

From a comparison of 300 case-studies it appears that, in one third of cases, effectiveness falls as class size rises, in another third class size has no effect and in the other third effectiveness increases with increasing class size.

It is also known, however, that difficulties are at their greatest in classes of over 70-80 students and that small groups generally learn better. In the majority of cases school classes fall somewhere between these two extremes, whence the difficulty of any precise measurement of effectiveness.

Effectiveness of textbooks

In some situations featuring a shortage of instructional materials and low-skill levels among the teachers (Philippines, etc.), experience has shown that a very considerable improvement in learning quality has been obtained by providing one-two textbooks per student. A far greater expense would have been involved in achieving the same result by raising the skills of the teachers.

Installation of a television system

Côte d'Ivoire has built up significant experience in the use of educational television. In the mid-sixties, the enrolment rate was 27 per cent (with wide geographical variations), under 10 per cent of teachers were qualified, more than a third of students were repeating grades and the drop-out rate was close on 20 per cent. A school television programme started up in 1971 with broadcasts and accompanying literature and training broadcasts for teachers. In ten years enrolment had climbed to 75 per cent, the disastrous effect of repeating had been eliminated, teachers could be 'further-trained' whilst continuing with their work and French language practice improved. Results, to judge by the evaluation studies made by Liege University, are good (except that proficiency in the spoken language is somewhat below expectations). Initially the cost of the operation came to 10 per cent of the education budget. Had the experiment been continued this figure would gradually have fallen to 3 per cent.

Recapitulative and estimative table of educational media needs and imports (for both formal and non-formal education), 1975, 1980, 1985, 1990 and 2000 (in thousand US dollars)

Education sector	1975		1980		1985		1990		2000	
	Needs	Imports	Needs	Imports	Needs	Imports	Needs	Imports	Needs	Imports
Africa	311.8	245.3	585.8	369.3	708.6	413.4	1020.4	549.9	1451.2	643.9
Latin America	659.1	182.7	1113.2	279.2	1437.6	360.4	1756.4	440.2	2669.5	668.6
Asia[1]	2198.3	595.8	3035.2	764.1	3500.4	881.2	3928.8	989.0	5003.6	1259.4
Developing countries[2]	3169.2	1023.8	4347.3	1304.2	5234.3	1570.3	6112.6	1833.8	8555.6	2492.7

1 Not including China, the Democratic People's Republic of Korea, the Socialist Republic of Viet Nam and Japan.

2 Not including China, the Democratic People's Republic of Korea, the Socialist Republic of Viet Nam but including Argentina, Chile and Uruguay, considered by UNESCO to be developing countries.

Source Huynh Cao Tri - 'Essai d'evaluation des besoins en materiel didactique des pays en developpement, 1985-1990', Table 32, UNESCO, June-September 1976 (UNESCO document ED-76/WS/77).

Given such levels of investment, needs require to be examined more closely and all the functions that must be considered to ensure sound management require to be fully grasped.

III. Needs and cost-effectiveness

Though costs can indeed be pinpointed - and later we shall see how to control and reduce them - it is still difficult to arrive at a clear analysis of what is achieved by using a particular educational medium.

The difficulty is to isolate the impact of one factor within a complex process in which several different resources are combined.

Even so, the overall results of education may be measured at the internal level by keeping track of cohorts (drop-out rates, repeating rates) or looking at marks obtained and examination results. Also, at the international level, researchers now have measurement techniques with which cognitive achievement in expression and mathematics can be assessed.

The application and combination of instructional materials to optimize results demands organizational arrangements specific to each country and detailed monitoring of their use. There is no one-only model; every country has to work out its own strategy and alternatives.

The following conclusions may be drawn from all the research that has so far been carried out:

In general, there is a certain threshold beyond which the marginal effectiveness of each medium decreases. Plainly, it is maximum where media and materials are few and practically zero where they are in plenty.

The optimum combination of educational materials depends on financial constraints (whence the importance of mobilizing local resources).

The marginal productivity of each input, taken on its own, decreases (e.g. above the level of three textbooks per student the increase in productivity declines).

The marginal productivity of extra cost decreases (higher costs but no appreciable improvement).

Costs rise with educational level (primary, secondary, etc.).

The less able the student, the higher the cost of cognitive acquisition.

Where there is a choice between several media or materials with roughly equal effectiveness, the less costly should be chosen.

The service and maintenance functions are never given sufficient consideration (to go to extremes, it is better to have foreign aid pay for renewing obsolete equipment than to tax the imagination to find materials and how to make them work - which is a perverse effect verging on waste).

The balance between financial resources applied to staff and to educational media and materials has been lost in many African countries to the advantage of the teachers, which causes many problems (media and materials either non-existent or having to be paid for by families).

A last point to note is that in many countries the most frequent scenario is a series of successive and random initiatives (sometimes with projects financed from the central budget) rather than the planned, phased and controlled introduction of educational media and materials.

IV. Application at national level

Using the following questionnaire, you should now be able to make a first analysis of the situation in your country.

The idea is not to conduct an exhaustive study but to take a pragmatic approach and try to draw up a diagnosis, a statement of the facts that describes things as they are.

1 Numbers and ratios:

	Students enrolled	Number of teachers	Number of classes	Number of schools or establishments	Number of students per class	Number of students per teacher
Pre-elementary, nursery school						
Primary (basic education)						
Secondary, college, *lycée*						
Technical and vocational training establishments						

2 How large is the non-enrolled population?

What action is being taken about the non-enrolled (distance education, education as part of a development project, educational radio/television programmes, literacy campaigns)?

What ministerial department(s) is/are running such actions?

3 Is there a standard list of compulsory or recommended media and materials for primary schools, colleges and *lycées*?

YES NO

If YES, can you provide one such list for a given level or discipline as an example?

4 To what sources of finance can a school, college or *lycée* apply in order to obtain educational media and materials?

Education ministry grants (give details of grants machinery)

Other ministerial departments or national institutions

Local authorities

Associations and foundations

Families

5 What costs are borne by the family at each level of education?

Can you give the price of the following (in national currency - state which)?

32-page exercise book

50-page exercise book

100-page exercise book

slate

box of white chalk

ruler

lead pencils

six coloured pencils

eraser

ball-point pen

exercise book cover

graduated ruler

compass

square

Average cost of a textbook for primary school

Average cost of a textbook for college

Average cost of a textbook for *lycée*

Cost of a school satchel

Average cost of a uniform (if compulsory)

Cost of other items that the family has to pay for

6 Can you give an estimate of total educational expenditure in your country for:

- primary schools _____
- secondary education _____
- vocational training _____
- teacher-training centres _____

if possible identifying the share borne by:

- education ministry
- other ministries
- local authorities
- families, parents
- foundations, private contributions
- foreign aid

What was the education ministry's total budget in

1986/87 (or 1987):

1987/88 (or 1988):

Do you know what percentage of this budget was for:

staff remuneration

premises and equipment

educational media and materials

Can you estimate annual expenditure in your country on the purchase, production and distribution of:

- consumables
- textbooks
- instructional aids for science teaching
- vocational training aids and systems
- audio-visual items
- computer hard and software

7 Can you estimate, for each of the above categories of media and materials, the *amount paid in hard currency* for imports:

- consumables
- textbooks
- instructional aids for science teaching
- vocational training aids and systems
- audio-visual items
- computer hard and software

8 Can you estimate the amount of foreign aid for these same media and materials:

- bilateral
- multinational
- other (foundations, missions)

What conclusions can you draw from your study?

No doubt in your country, as in all the others in the region, there are:

considerable needs

enrolment rates compared with the real social demand for education;

increasing number of children to be educated;

very low percentage of public education expenditure applied to media and materials;

classes too large for optimum use of educational media and materials;

inadequacy of non-formal education activities;

etc.

high level of dependence

on *imported* media and materials (in most cases imported by a supplier, not the manufacturer, which limits local maintenance possibilities);

on foreign aid;

etc.

V. Functions to be considered

From this analysis and its conclusions, one dominant idea emerges:

the need for strict management

of educational media and materials.

Before you study the following paragraph, see whether you can think of the different functions that have to be taken into account for sound management.

Such management requires that, at different levels of responsibility, four principal functions have to be ensured:

planning;

provision;

distribution;

monitoring of use.

In addition, other factors have to be considered relating to maintenance, the training of managers and users and evaluation.

Often, specialized services have to be set up. These are discussed in Module No. III.

V.1 Planning involves:

collecting data on what already exists;

identifying the needs to be met;

classifying costs and analysing resources;

drawing up a strict but flexible programme which applies the solutions decided upon so as to achieve the objectives set in the most successful way.

For example, a priority objective could be to *improve the quality of primary education*, or to modernize education as part of a reform or to extend educational services to specific groups (specialized education, non-formal education, extra-mural activities, etc.).

Quantitative needs can be worked out by the statistical facilities with which all education systems are gradually equipping themselves. To accompany this quantification exercise, a qualitative analysis could usefully be made by working parties or committees bringing together *researchers, technicians and teachers.*

Needs must also take into account what already exists and the way existing media and materials are used and, as well as that, the constraints on the production and introduction of the various instructional media and materials.

This planning exercise often ends in the adoption of *fixed standards* under which given media are allocated in given quantities to each establishment.

Inventory, classification and measurement of costs are sufficiently complex to call for special treatment as follows - taken from "The educational administrator and educational materials" which has already been quoted.

Costs

It is not an easy task for the administrator and the planner of instructional materials to measure costs. However, these difficulties must be overcome if budgetary estimations are to be made. Quantification implies that all economic and financial factors involved in the short-, medium- or long-term implementation of instructional materials are taken into consideration. For example, for textbooks, long-term investments must be taken into account because the drafting, editing and distribution of a series of volumes requires several years, not counting the time taken for research and, when such structures do not exist, for the establishment of publishing and distribution

houses and infrastructures for various categories of educational personnel concerned: specialist authors, editors and revisers, teacher trainers and users.

Even if decisions on financial and economic questions are finally taken most often at government level, they are based on the outcomes of cost studies.

Classification of costs

Four types of classification of a complementary nature seem necessary if a complete picture is to be obtained: (a) *a technical classification*, in which costs are categorized according to the various technical operations that have to be carried out to ensure delivery of a particular message; (b) *an economic classification* distinguishing fixed and variable costs; (c) *an accountancy or budgetary classification* differentiating capital costs and operational expenditure; and (d) *a financial classification by contributor*, whereby a distinction is made between direct and indirect costs.

Technical classification , which indexes the cost of different phases - design, production or manufacture, distribution or transmission, reception or use - is one of the most important in planning, especially for large-scale production or the use of radio and television. The relative cost of each phase varies considerably according to the nature of the technique and the method of production used. With television, broadcasting costs are generally higher in relation to production costs than is the case with radio. However, this classification is not sufficient on its own because it provides no means of establishing whether costs fall under the heading of initial establishment expenses or current operational expenditure.

Economic classification makes a distinction between variable and constant costs (fixed or recurrent) according to the size of the operation. Certain fixed costs are constant costs, i.e. incurred only once, or recurrent, i.e. are repeated from time to time. Fixed costs cover, among other things: purchase or leasing of apparatus (radio or television receivers, cinema projectors or screens, amplifiers) and certain service costs such as salaries of maintenance personnel. Variable costs cover purchase of tapes, recording heads, projector lamps, etc., the cost of which varies over a given period according to the number of recording hours and the salaries of those who are the link between the equipment and the students (technicians, supervisers, etc.).

The distinction between fixed costs and variable costs is fundamental in any analysis of the cost of educational materials, because it is in this way that their planning differs substantially from the planning of traditional teaching. Traditional teaching essentially implies variable costs, proportionate to the number of students. If twice as many students enrol, then twice the number of schools, books and teachers are needed and the cost per student remains the same. At most, small administrative economies can be made (a second minister is not necessary), even though experience has shown that administrative

expenditure per student does not tend to diminish during expansion of education systems.

With educational materials, the cost structure is completely different. If radio and television programmes, sound cassettes or video cassettes, computerized programmes, or films are produced, then the design, devising and production of original materials are fixed costs, totally independent of the number of students who will use them. In the same way, if radio and television programmes are broadcast on the same wave length, the distribution cost is independent of the number of listeners or viewers. Contrary to variable costs, these fixed costs are inversely proportional to the number of students. However, the staff provided for the students, the reproduction of materials and the reception equipment remain variable costs. Depending on facilities involved, the percentage of fixed costs will be higher (radio) or lower (language laboratory, where only the building up of stocks of original programmes will be a fixed cost).

An *accountancy or budgetary classification* makes a distinction between investment costs (or capital expenditure) and operating expenditure. It is useful in that it allows a comparison to be made between initial costs and the current operational costs of an established system.

Financial classification by contributor reflects the difference between costs borne by the institution, those to be met by households or users and those falling to the local or national community.

Calculation of unit costs

In addition to global costs, unit costs should be established as an objective unit of calculation which can be used independently of the diversity of content and its quality and, above all, be compared according to the conditions of use of the educational materials, the materials themselves and the levels of teaching considered. In practice, two units are used for modern educational media: (a) unit cost per student, which corresponds to the cost of an item of equipment (e.g. a machine-tool) divided by the number of users; and (b) cost per student hour, which corresponds to one hour of interaction between the student and a given educational medium (for media of no fixed duration, printed texts or slides, student cost per page or per slide can be used).

Calculations of cost should not be limited to the average cost per pupil per year. This is not sufficiently significant as far as volume (measured in time or quantity) of contact between a given medium and a pupil is concerned. Access to a radio programme for one hour per day is not the same as access for one hour per week. Annual cost can be deceptive if it is not quantitatively corrected.

Hence an overall estimation of the annual contact time with the medium should be established and the cost per pupil and per year and should be divided by the number of contact hours if any inter-media or inter-system comparisons have to be made.

Critical mass

There is a minimum of equipment below which the cost-effectiveness calculation is distorted. Efficiency can be low because of the small audience for media and/or the small number of users of educational materials. It is necessary therefore to plan for situations where they will be fully used. Seeking this optimum situation will lead, for example in the case of communications media, to maximizing the number of messages distributed over the same channel, to using the same type of medium for the greatest number of messages (and not a specific medium for each subject) or to extending periods of use of facilities (access in the evenings, during vacations, etc.).

Whatever the effectiveness of any educational material and whatever its quality, no increase in the effectiveness of instruction at the national level should be expected unless a critical mass is reached, i.e. a certain quantitative use of the material. If the critical mass is not reached, there will inevitably be coexistence of two systems: the old one at full cost, the other at additional partial cost, resulting in increased expenditure without substantial improvement in effectiveness.

It could be interesting to establish a threshold of economic efficiency, i.e. the point at which a system using educational media becomes more economical than a traditional one. Thus, when no economy of scale is possible, for example by increasing the number of hours per student, it can sometimes be more 'profitable' to strengthen traditional educational practice by taking it to its optimum level of effectiveness (better staffing, grouping of students) than to introduce costly under-utilized materials, whether these be machine tools, television sets or language laboratories. Conversely, a relatively small increase in current expenditure - for example systematic provision of radio or television receivers - could lower the unit costs of some systems.

So the purpose of planning is to determine the best ways of using available resources by striving to harmonize (using regulations if necessary) the inputs from the different possible sources of finance (foreign aid, central government, parents ...). It is easier to put into practice in education systems with a centralized organization and less so in countries where the organization is highly decentralized (where planning cannot be authoritarian but only offer guidance and incentives).

V.2 Provision

With this second major function it is a question of making available the educational media and materials whose use has been planned and programmed.

Provision may be ensured in various ways (imports, existing national production, production within the education ministry, encouragement from the education ministry for the formation of new 'education businesses', etc.).

Regardless of how provision is secured, a number of studies need to be carried out by specialized units (belonging to the ministry or to an independent establishment working under the instructions of the ministry). The object of these studies will be to:

formulate technical standards (rationalization, standardization, ensuring proper utilization);

determine selection criteria - and the ways in which selection is made - for existing instructional materials;

draft specifications, prepare orders, *award contracts*;

arrange for *long-run production* for domestic manufacture; and

check the quality and conformity to specification of products supplied.

V.3 Distribution

Where organization is centralized, educational media are most often supplied free of charge to users and distributed to schools by the educational authority through endowment procedures, on the basis of standard lists drawn up at the planning stage.

In this case it is the task of the education ministry to plan and be responsible for:

constituting adequate stocks and arranging for their storage;

checking that the products conform to specification;

forwarding materials to where they are to be used and ensuring they arrive by the time they are required.

If, in the same type of centralized organization, endowment is not in kind but in the form of financial resources it is necessary to make sure that appropriate regulations exist governing their use.

In a free economy, it is usually the manufacturer of educational materials who is responsible for informing users and delivering the products. The role of the administrator in this case is to ensure that delivery dates laid down in the contract are complied with.

In addition to distribution on its own, this heading also embraces:

training of users; and

service, maintenance and repairs.

V.4 Monitoring the use of educational materials

In addition to maintenance and the training of users referred to above, *monitoring the use of educational materials* is one of the most difficult functions to provide for. The problem of evaluating efficiency is often more than a management responsibility but the administrator is required to set in place a system of procedures and mechanisms for supplying the necessary information on how educational media are used and on the attitudes of teachers.

These procedures and mechanisms include:

the systematic organization of feedback from users (e.g. users borrowing a book, a film or courseware should have to fill in a simple form giving their first impressions);

the conduct of periodical surveys giving full information on numbers and intensity of use of materials and audience ratings for educational radio and television broadcasts;

the inclusion in school inspectors' reports of information on equipment and its utilization;

co-operation, on a wide basis, with professional associations and specialists in various fields;

the setting up of specialized committees of the various persons involved;

the organization of research projects on the effectiveness of a given medium with the help of specialized national institutions.

One way of consolidating what has been learned in this second section of module I is to cross-tabulate the information provided and fitting it in to a new presentation.

Think about a study of educational media and materials by major function, but involving, in turn, two other criteria:

1. At what level or grade of responsibility should a given function be performed?

   The following table may help.

Function	Operation	Level at which to be performed[1]
		National, district, local
Planning	• Explanation of objectives • Identification of requirements • Inventory, classification and measurement of costs • Programming and financing	
Provision	• Technical standards • Selection • Orders and contracts • Production • Quality control • Information	
Distribution	• Plans • Storage • Allocation - in kind - financial • Inspection	
Utilization	• Maintenance • Monitoring use • Information • Training	
Research and development	Organization of projects	

1. The levels at which operations are carried out will depend on the context (centralized/decentralized system, economic organization, how much responsibility is given to schools and establishments, etc.).

2. How do the functions studied vary with the different instructional materials?

   The table on the following page may help.

Using a diagram, can you describe the system used in your country for the acquisition, distribution and management:

of textbooks;

of science teaching materials?

TABLE 1: ANALYTICAL TABLE, FUNCTION BY MEDIUM

Functions / Media	Functions to be considered: for each function WHO DOES WHAT OR HOW?															
	PLANNING PROGRAMMING				PROVISION, PROCUREMENT				UTILIZATION, DISTRIBUTION				MANAGEMENT AND MONITORING USE			
	Information, needs	Analysis, studies, standards, selection, approval	Choice of promises	Programming	Importation	National market	Internal production	Creation of education industry	Distribution	Training of users	Maintenance	Follow-up, educational assessment	Funding	Cost-benefit assessment	Regulations	Training of administrators
Textbooks																
Consumables																
Courseware and packages																
Equipment for technical education																
Audio-visual																
Computer hardware																

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Section III: Practical implications of the use of educational media

Summary

Another approach to the problem is to simulate an educational system using a combination of media and to work out the implications of such a situation in terms of:

1. staff;
2. documentation and distribution;
3. production;
4. assessment;
5. administration;
6. finance;
7. equipment.

The educational system is not necessarily ready for the introduction of educational media, which imply many changes (or, if no changes are made, much resistance).

The following study by Robert LEFRANC reviews the implications of the introduction of a multi-media system - i.e. one in which several media (print, radio and television) are combined - in a face-to-face educational system.

This is therefore another way of studying the problems we met in the first two sections of Module I.

Try to transpose this study and apply it to a system of distance education or non-formal education. Is the foreseeable resistance as strong or manifest in as many forms?

Lastly, note that it is very difficult to generalize because some implications or impacts vary considerably depending on the kind of administrative structure there is and the state of technological progress.

What is the situation in your country?

The arrival *en masse* of new technology is not innocuous and necessarily involves radical changes. The combinational approach reflects the concern to incorporate media into coherent functional systems. Like all systems, education is

governed by laws of internal equilibrium which resist change. There is no way of introducing new media into unchanged operational frameworks and structures. From that viewpoint, therefore, change is a necessity. No new introduction can simply be added on; all innovation necessarily has a restructuring effect. The reasons why the school system has difficulties in absorbing the new communication technologies need to be researched. Introducing these new technologies into education and wanting to make them an integral part of it therefore necessarily means rethinking the school system and its traditions, architecture, materials, rules and hours of operation, curricula, methods, modes and criteria of assessment, in other words all its forms of organization in space and time and the qualifications and duties of its staff.

I. Implications in terms of staff

First and foremost, the use of multimedia systems implies radical changes as regards the people employed in education. The success of what is done will depend on their quality and suitability, for deep-reaching reforms of traditional school and university education are involved.

Teaching staff

The fact is that in most educational establishments, the staff, except for the office staff and service personnel, is composed essentially of teachers who, whatever their university qualifications may be, are responsible for education as such and the job they are expected to do, in essence, is to impart knowledge.

The use of multimedia systems, however, requires the role of the teacher to be reconsidered. It is no longer sufficient for a teacher to be able to pass on knowledge and skills. He has to be much more of a guide to the student and help the student to organize his learning; his role is that of a mediator. One of his essential functions is to know his students well enough to be able to counsel them on the basis of that knowledge. He has to be able to assess his own performance and judge the teaching process as a whole and the various players involved. He also has organizational responsibilities, and some authors would like to see educators called 'education engineers' on the grounds that this would more accurately reflect the content of the job.

It should also be noted that this diversification in teachers' work implies a distribution of tasks in each establishment that will be new and very different from the present situation in which practically all teachers teach students face to face. While some still remain specialists teaching their chosen subject, others are essentially co-ordinators or team leaders and yet others devote the major part of their time to production. This kind of subdivision is probably likely to take more account of people, aptitudes and skills than of university degrees.

The introduction of methods based on education technology inevitably means setting up teaching teams of people with different jobs. This is the idea of a collective educator, an educational community, an 'open area' institution. From this standpoint, educational technology completely overturns the perspective of traditional pedagogics: it replaces the image, which is still current, of a master on his own, teaching a set of undifferentiated students in the closed environment of a classroom with the more functional idea of the pooling of human and material educational resources enabling teaching and learning to be individualized.

On this point we would draw attention to the very special make-up of the teams that work together in teaching by correspondence and the more complete and varied teams that produce distance education courses.

In fact, the spectrum of jobs, very restricted in traditional schools and universities, is becoming increasingly wide, ranging from teaching team leader via special subject teacher to supplementary and supporting staff such as junior teachers and instructors, to say nothing of the non-teaching categories described below.

Documentation staff

Diversification needs really to be taken much further. The proportion of teaching staff in the strict sense needs to be lower in relation to other categories whose role is no less essential.

This applies to documentation staff. No multimedia based educational activity is possible without a sound documentary basis and a plentiful and rational provision of materials of all kinds. The customary librarian is no longer sufficient since books are only part of the necessary documentation. Such staff have to be recruited from specialized documentalists able to run a learning resources centre and also able to make use of computers and data banks to optimize the documentation supply.

Research staff

Multimedia education requires continuous adaptation and constant assessment. Every system of any size will include evaluation specialists capable of collaborating with psychologists and sociologists, part of their work being complementary.

Technical staff

The number and degree of specialization of technical staff will depend on the scale of the multimedia programme but in any case the usual solution of only one (or practically only one) 'jack-of-all-trades' will be discarded and

greater specialization aimed at. One technician will be required for the language laboratory(ies) while others will be needed to ensure that the video equipment is in running order. Some technicians will be mainly occupied on maintenance.

The number and quality of technicians should be carefully analysed in relation to the scale and nature of the hardware at the school.

Production staff

Since each establishment is responsible for some production as a necessary condition for the rational use of multimedia, the items produced by the school or the university supplement industrial production and help to tailor the mass media to their educational role.

This being so, diversified production staff will be needed, ranging from producers to cameramen and editors via sound engineers, artists and electricians.

II. Implications as regards documentation and distribution

No multimedia system can work without a solid documentation and distribution infrastructure which will vary from country to country according to the school system and administrative structure. Roughly speaking, however, bases can be found at three levels: national, provincial and local.

The very nature of these bases needs to be rethought. In many countries there are libraries, film libraries, record libraries, etc. At all levels, all the various media, including publications, need to be brought together in one and the same place known as an educational media centre or learning resources centre. But this is an active documentation centre indexed and inventoried not for the purposes of stock-keeping but with use, easy access for all (teachers and learners) and dynamic integration in a learning process in mind - whence the name of learning resources centre.

Organization and jobs will differ with the level at which the centre operates.

National level

This level provides educational establishments with: (a) radio and television programmes which are broadcast over the national networks and used live or are recorded by the establishments; and (b) films and video or sound recordings of general and national interest. It also supplies relatively rare materials that schools would be unable to obtain for themselves or would have to borrow.

This is also the level at which sample collections are often to be found of various audio-visual materials, like slides and records, which are mostly borrowed by teachers to consult and examine with a view to purchase, but not for class use.

Provincial level

The role of provincial resource centres complements that of those at national level by bringing certain general interest material closer to users and offering the fullest possible collections of material on the region. They provide easier access for the consultation of collections (at the centre or on loan).

Local level

Local level learning resource centres may be of two kinds:

district or city learning resource centres

The current trend is to skip the provincial level and concentrate documentary resources in a school district because then they are easily accessible to all the educational establishments in the district concerned. Teachers can come on foot or by short car or bus ride. Finance comes from the district authority and/or the various establishments concerned.

Among other things, these learning resource centres enable more efficient use to be made of costly material which would not get sufficient use in only one school.

school learning resource centres

These are the key structures. Whatever the scale and number of national, provincial and local centres, those at school level are essential. They are one of the key components of establishments using multimedia learning systems and one of the places in the school most frequently visited by teachers and learners alike. Here the material is not classified by its technical nature but by subject. The accommodation and the equipment is arranged so as to invite consultation, whether in groups or individually, and everything needs to be organized to contribute to a 'help-yourself' atmosphere.

In sophisticated systems, documentation is computerized and the installation is either automated or equipped with a computer terminal.

III. Implications in terms of production

General principles

All these distribution channels have to be supplied by an educational industry producing audio-visual material and software as yet not well-suited in most countries to the requirements and needs of education, the point being that, whether they be public production units or private companies, they continue in most cases to produce a series of isolated documents. One will specialize in film-making, another in records and another in slides. Centres and companies capable of producing a whole range of co-ordinated media are rare. Those that produce audio-visual media, moreover, rarely produce books and other printed items whereas the reverse is tending more frequently to be the case: many publishing houses now have an audio-visual or even computer department.

What is needed is media production that is co-ordinated well before the end-stage and as required to suit the purposes of the package or the learning unit. All too often, co-ordination is only thought about afterwards when frantic efforts are made to fit together material originally designed for different purposes.

The education industry needs to be able to offer multimedia packages of different kinds: complete methods as in the case of many modern language methods, homogeneous series, semi-industrial products and open series which have to be supplemented at the level of the school. A characteristic trend is for the production of modules or educational 'building bricks' that can be adapted for various purposes in educational establishments. They can be bought separately or in combination in multimedia packages, under the generic name of 'package instruction'.

The distribution and use of all these materials raises the tricky problem of copyright. This whole question needs to be reviewed from square one so that the use and reproduction of printed and audio-visual media does not have to comply with the same rules as those governing the general public domain of information and the performing arts.

Production - who and how

Educational media are produced at several levels.

International level

Many public and private bodies that produce for a whole country also produce for export, at least for countries in the same language group. Directly or in association, some produce for international purposes and several experiments in co-production are known to have succeeded at this level. Co-production is even institutionalized in some international organizations. The growing number

of communication satellites and transnational television and radio networks will increase the proportion of educational production originating in this way.

National level

This is the principal level in terms of volume and scale of investment and production. In countries with centralized educational structures, production is governed by curricula established at national level, sometimes on rigid principles and standards. But the competition there, often between private enterprise and public bodies or within private business itself, results in a great variety of material being available on the market, thus offering a real choice, at least in certain fields because others are less well supplied, production tending to concentrate in those fields, areas or disciplines where demand is greatest. The public bodies can help by acting in an advisory or regulatory role.

Provincial level

At this level, the function of production is to supply items tailored to the life or nature of a region. The public or private producing agencies are often branches of national bodies or firms so that co-ordinated interregional production is possible.

Production at this level, essential for the regionalization of education, will certainly grow vigorously in the future in most countries.

Local level

This level, likewise, is essential. The massive, systematic introduction of multimedia systems in educational establishments means that these establishments will have to produce a large amount of material themselves.

For one thing, they have to supplement bought-in multimedia packages or modules, in order to adapt them to local conditions and for another, they have to produce their own as part of the creative teaching process which requires them not to be just the slaves of the mass media but to use them like a craftsman would a tool.

For this, a variety of equipment is required, in some cases relatively simple and low in cost such as still and motion-picture cameras and tape recorders, and in others more costly such as equipment for the production of cinema or television films. Some establishments have their own well-equipped sound and video production studios manned by skilled technicians.

But it would be wrong for production to become the victim of an excess of technology to the detriment of the freshness of the inventive spirit. What counts most of all is that producers, teachers and learners should share in production and

that everyone should be involved alternately as spectators and players and as producers and users. Production on this shared basis is one of the best instruments of active, media-reactivated teaching and learning.

IV. Implications in terms of assessment

The intensive use of multimedia systems and educational technology is inconceivable without a feedback system as an integral part of the teaching/learning process and without continuous assessment of achievements, measured against the objectives it had been hoped to reach.

By 'assessment' we mean procedures which enable the failure or success of a policy and its implementation to be judged and the opinions of those responsible for operating and those benefiting from the system to be tested and interpreted. Given these definitions, the activities involved may be simple and direct or, on the contrary, complex, employing sophisticated statistical and other methods. They may call for intuitive professional judgements, which should not be underestimated simply because they do not lend themselves to quantitative verification.

Research and assessment have more importance for multimedia and, in particular, distance education systems than traditional education has generally accorded them.

There are several reasons for this.

(a) The circumstances surrounding innovation are such that it is wise to back up proposals for innovation with as much relevant data as possible, particularly when the proposals call for a high level of initial and repetitive expenditure, involve long-term commitments and seem likely to swallow up foreign exchange or human and financial resources in short supply. The likelihood is that the good name of prominent persons will be involved in such projects.

(b) In distance education systems, educational materials have to be produced in advance and distributed which cannot afterwards be withdrawn from circulation and have to last many years. In the case of printed matter, it is not easy to make large numbers of corrections by means of errata slips and altogether impossible to do so in the case of gross errors of educational judgement. It is also difficult to correct mistakes in radio broadcasts although action by instructors or corrigenda issued to students are helpful. If local centres are involved in the system it is also theoretically possible to ask the instructors to make changes orally but it means that an additional link has to be wired in and weakens the authority of the distribution agency. There have been cases where a difference in opinion has emerged between those responsible for the centre that supplies the

material and the university staff interpreting it, inevitably sowing confusion in the minds of the students.

(c) The educational material used in distance education is produced by highly skilled people who are necessarily without any contact with potential users during the course of their work, for it is difficult for them to have ongoing contact with representative students, whose original cultural background will differ greatly in many cases from that of the students they do frequent. The changes in style, tone and density intuitively introduced in the lesson when face to face with the learner can only be the result - in this kind of education - of research and assessment.

(d) Just as the best way to exploit the educational potential of radio broadcasting is to build it into a complete educational package, the best way to realize the potential of research and assessment is to place them in a system where they are both the servants and the guides of the authors of the lessons and the representatives and interpreters of the consumers. The history of the use of 'modern media' over the last 30 years is strewn with disappointments and misunderstandings due to the lack of organization in this respect. The need for research and assessment capacities inherent in multimedia distance education systems enables this shortcoming to be corrected.

Research and assessment are an integral part of all distance education operations worthy of the name but their contribution differs at the different levels.

Basic research

Basic research consists in gathering together the information necessary to justify the creation of the proposed institution or service and to describe them in sufficient detail for the plans to follow to be convincing.

Formative research

'Formative and cumulative research are complementary. To simplify things it may be said that the former, conducted in concert with lesson creators, helps to establish a functioning system while the latter makes it possible to tell whether the system has worked properly, and if not, why not. Depending on the size of the system, these matters may concern university staff, lesson designers, writers, radio and television specialists, producers of all kinds of sound or audio-visual materials, artists or publication managers.'

Cumulative research

'Since, at this stage, results are the main issue, objectivity and detachment are all-important, so outside research services are often called in. The use of the organization's own research staff is also recommended, particularly when the

problem is to bridge the cultural divide between the suppliers of the lessons and the target audience.'

Strategic research

'The need for continuous research on the functioning of an open learning system, often termed "institutional" research, cannot be too greatly stressed. Without any doubt, a system of this kind, sometimes boldly innovative at the start, requires a constant watch to be kept in order to make sure that it fulfils its prescribed purpose and to make the changes that will assuredly be necessary to its structure and its operating methods and to identify the future directions for its strategy to follow.'

The scale of this research and assessment will vary, of course, with the nature, scale and resources of the systems concerned.

V. Implications in terms of administration

These are numerous and pose serious problems because the administrative machine is often the main obstacle to innovation in education. The inertia of the institutions is sometimes so great that it paralyses initiative and rejects new graftings, in which case, if radical changes are not made to administrative structures and procedures, it is pointless to try to introduce multimedia systems into education.

Rules of the establishments

The rules governing schools and other establishments were drawn up as satisfactorily as possible in the light of traditional educational methods, conventional curricula and staff made up almost exclusively of teachers. The administrative rules under which they operate are so many impediments to the changes, or rather upheavals, caused by the introduction of multimedia systems.

In order to provide favourable ground for these systems to root in, several countries have enacted rules for experimental and pilot establishments, a justifiable procedure provided it does not result in their becoming isolated on the fringes of the educational system but instead leads, by a kind of ripple effect, to the gradual transformation of old into new.

Staff rules

We have already seen how varied the staff have to be so the rules for the different categories - teachers, documentalists, researchers, technicians, etc. - have to be carefully worked out, with bridges built in where possible to provide the mobility necessary for switching from category to category: some teachers

may be very good authors, certain technicians may be expert at holding children's attention.

In particular, teaching staff rules need to be carefully revised in accordance with the following principles. University degrees count far less than the ability to teach and the readiness to learn while teaching, for anyone who refuses to learn is not qualified to teach. Remuneration needs to be less related to university qualifications than to the jobs actually done over the whole range defined above, from head of department to instructor via teacher-producer. In particular, the notion of maximum service based on traditional classroom teaching needs to be completely overhauled since the greater part of teachers' time will be devoted not to that kind of activity but to counselling, producing, co-ordination and discussion, etc.

Review of curricula

This is all the more necessary when curricula are obligatory and national. The operation of multimedia systems is wholly incompatible with a strait-jacket curriculum decided for the whole of a country by some national office or committee. It should be possible for one subject to be dealt with in preference to another and over a period of time whose length may vary from one establishment to another. Local subjects, too, should have a place in courses of study, selected with discernment by teachers and learners.

The only kind of curricula acceptable in this modern educational approach are those which primarily offer guidance, are flexible and provide a broad framework for study.

More flexible school hours

In traditional establishments, the school day is broken up into a number of periods, depending on level and country and varying from 30 to 60 minutes each. These rigid timetables hardly give students time to change teacher or room.

Multimedia systems require a high degree of timetable flexibility. Sometimes short information sessions are needed, sometimes long periods in the laboratory or for work in groups. Sometimes the brief presence of the teacher is enough, sometimes students need to spend an entire half day with a teaching team.

Some organization of time is essential and therefore many establishments select a small time module, e.g. 20 minutes, and on that basis build up timetables for each week using multiples ranging from a single 20 minute unit to periods lasting several hours. What is more, the arrangement is not of the 'ne varietur' kind and may be changed at the suggestion of teachers and students.

VI. Financial implications

Financing arrangements need to be reviewed, and in particular the distribution of funds over time and in volume. Keeping to basics, what is necessary is a new method of distributing investment and operating appropriations.

New distribution of investment

In school and university systems, appropriations are split under two main headings: investment and operational expenditure. Investment appropriations are mainly taken up by building costs, a small share going to the fitting out of school and university buildings.

In the case of establishments making intensive use of multimedia systems, however, this proportion needs to be completely changed. It is evident that, for a language laboratory, for example, or a television studio, to say nothing of a physics laboratory, the cost of the equipment far outstrips that of the room housing it. The content costs much more than the container.

The proportion changes even more and can even be inverted if not only hardware but also material and collections of material have to be procured, so the initial cost of equipping a learning resource centre in a school may be very high indeed.

New distribution of operating appropriations

In traditional establishments, operating costs largely consist of the salary bill, teaching staff representing 90-95 per cent of the total.

This proportion has to be completely changed in schools using multimedia systems, a large share - up to 20 or 30 per cent - going on other running costs such as hardware maintenance and the production, purchase or rental of material and software.

Because of these requirements, some establishments have - quite rightly - sought to improve the return on their equipment by opening their doors to adults outside school hours, particularly in the evening and at weekends. Language laboratory facilities, for example, can be used full time in adult education programmes. The rental paid is set in such a way as to reduce the maintenance costs that the school has to pay out of its own funds.

In fact, financing structures are much more complex than this, particularly for highly sophisticated multimedia systems.

The International Colloquium on 'Economic analysis as an aid to educational technology decision-making', held in 1977 at Dijon University, drew attention to the cost classification table put forward by UNESCO/ILO for programmed instruction, which can be transposed to educational technology in general.

A. Pre-production costs

B. Design and production costs

C. Launch costs

D. Reproduction costs

E. Distribution costs

F. Application costs

each of which is broken down by type of cost:

I. Staff, media and materials

II. Hardware (large and small-scale) costs

III. Construction costs

IV. Overheads

In the UNESCO publication in the same collection that contained the follow-up to the papers presented at the Colloquium, J.C. Eicher identified four ways of classifying costs:

technical classification (cost per operation);

economic classification (variable or otherwise);

bookkeeping classification (investment/running costs);

financial classification (direct or indirect by source of payment).

Cost-effectiveness analysis is not an end in itself. When such studies are possible, they always have some value even though the primary purpose of these systems is not to reduce the cost of education. But such studies do enable the return on education systems to be constantly improved and they also help to guide decision-makers in their choice.

VII. Technical implications

These are considerable as regards both buildings and hardware.

A new school architecture

The use of modern technology and even more so that of combined media systems is often limited, even handicapped, by traditional or out-of-date school premises that are completely unsuited (a) for the application of modern, active teaching methods; and (b) for viewing or listening to audio-visual material in the right conditions.

Whatever is done - makeshift rearrangements, black-out curtains, sound-insulation and so on - the results are often disappointing.

The only real answer is to build modern premises designed for the purpose and complying with simple rules. The starting-point is the triangular module (the best type of space for viewing a screen or television monitor) with space for 20-30 students, of which 2, 4, 6, etc. can be put together to form a hall for 150-200 students. The module itself can be subdivided into cabin-sized 'carrels' in which small groups of students (6-12 for example) can work together.

The keyword is quick-change spatial flexibility. In the past, the usual solution was to have movable partitions but they created problems, particularly from the point of view of acoustics. Currently, the trend is towards modules that are heavier but can be easily diversified by moving them together or apart. With such modules the possible combinations are infinite; the architecture is totally free of monotony.

The furniture needs to be easily movable by the students so that it can be arranged differently for the next learning activity.

Hardware

As we have seen, the equipment required is considerable and costly, particularly for technical set-ups like closed-circuit television, language laboratories and production studios. Costs would be far lower if only the hardware necessary to use media were required, but active, media-based education is inconceivable without some production resources.

A real educational hardware industry has to be developed to supplement the hardware that schools can obtain on the general market. This industry is still in its infancy and often insists on producing special equipment for schools in fields where the best hardware already on the market would suffice, whilst refusing to research and develop specialized products that are not available. Admittedly, the educational market is as yet a small target at the national level.

The only answer is to work for the international market and base production on serious research into users' real needs.

Lastly, the application of multimedia systems is often handicapped and retarded by problems of non-standardization and incompatibility.

Conclusion

These practical implications of the introduction of multimedia systems in educational establishments need to be adjusted in the light of the scale and pace at which they are introduced. They depend on the strategy being followed.

If one just sets up an experimental sector or pilot centres, the quantitative implications will not be great, at least not in the fields listed above. However, it will be possible in this way to assess and measure more successfully what those implications are, with a view to the planned introduction of multimedia systems throughout the school system. When some impacts change in volume, however, they also change in nature as soon as a certain 'critical mass' is reached and it is only when the economic viability of the whole is certain that changes in rules, curricula, investment and so on will be justified at the national level.

Another possibility is to promulgate a revolutionary reform involving the simultaneous transformation of the whole of the educational system. Since all the implications would arise at one and the same time and *en masse*, planning would have to be very tight. Such a scheme would seem difficult to implement without preparation in the form of an experimental phase in a pilot sector.

Without this, if faced with increased difficulties and failures, the authorities responsible would be severely tempted to conclude that it is impossible to renovate the education system from within and to decide to institute one or more multimedia distance education systems, which in such circumstances would inevitably develop in competition with each other.